Power Consumption Reduction for Wireless Sensor Networks Using A Fuzzy Approach

Giovanni Pau*

Faculty of Engineering and Architecture, Kore University of Enna, Italy.

Received 09 November 2015; received in revised form 08 December 2015; accepted 15 December 2015

Abstract

The increasing complexity of Wireless Sensor Networks (WSNs) is leading towards the deployment of complex networked systems and the optimal design of WSNs can be a very difficult task because several constraints and requirements must be considered, among all the power consumption. This paper proposes a novel fuzzy logic based mechanism that according to the battery level and to the ratio of Throughput to Workload determines the sleeping time of sensor devices in a Wireless Sensor Network for environmental monitoring based on the IEEE 802.15.4 protocol. The main aim here is to find an effective solution that achieves the target while avoiding complex and computationally expensive solutions, which would not be appropriate for the problem at hand and would impair the practical applicability of the approach in real scenarios. The results of several real test-bed scenarios show that the proposed system outperforms other solutions, significantly reducing the whole power consumption while maintaining good performance in terms of the ratio of throughput to workload. An implementation on off-the-shelf devices proves that the proposed controller does not require powerful hardware and can be easily implemented on a low-cost device, thus paving the way for extensive usage in practice.

Keywords: wireless sensor networks, fuzzy logic controller, power consumption, IEEE 802.15.4

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* Corresponding author. E-mail address: giovanni.pau@unikore.it

Tel.: +39-0935-536494; Fax: +39-0935-536623

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